Marbled Murrelet Population Team Meeting
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Meeting Overview

We spent most of the meeting discussing sampling design issues and we also talked about survey methods. Jeff Laake from the National Marine Fisheries Service joined us for the day to discuss the results of the Boat Avoidance study and the implications for the survey methods. We briefly discussed a schedule of completion of a population monitoring program including time for peer review before beginning implementation in 2000.

Sampling Design

SB presented power trend data for some transect configurations using a clumped along shore distribution (used their 1997 data which the group felt was severe but realistic). He showed histograms of the computer modeled clusters (cluster 3 for example seemed to have the greatest variation). Daily variation was incorporated and derived by fitting a curve to the intensive parallel densities. TM concerned about the derivation of these curves (and reminded the group that the sampling design must be robust against variability in time and space). The along shore clumped distribution was based on one distance offshore. Q: Does that mean the birds might just be redistributed offshore when we see an along shore clump? A: If that were the case, the intensive surveys would show some of that (although the intensives covered a limited area; in 1997 only two areas had intensive coverage). The simulations assume independence of along shore and offshore distribution.

Configuration: One parallel 80km transect at 550 m off shore. Not a lot of difference for power. TM asked for a break out of the component parts of the simulations. Need an estimate of bias and sampling error separately to be able to make inferences about how robust these simulations are.

Configuration: Four parallel 20 km transects - 4 onshore/0 offshore. See more differences in power. See lower power in clusters 1(50%)/3(50%) which are the 2 clusters that are most different. As they finish the simulations on the shorter 8 km segments (10 of them) expect to see greater differences in power with the clumped distribution.

SB - These are simulations of indices. Indices and abundances are different parameters. These measures are not going to test them the same way.

Q: Have you run a simulation of a fixed cluster to see if the results make sense (a sort of cross check that was suggested at the last meeting)? A: Not yet. They collect data on the density estimate for the first year of each simulation which gives you an idea of how many birds you

would count to help look at the bias. JB Can get formulas for those counts. SB believes these simulations are probably overestimating power since all those other factors of observer variability, etc., will still be there. This is a comparison tool for transect configurations.

Q: Is SB going to run transects to help us with the sampling design? A: Planning to do perpendicular simulations. For zigzag, both SB and CT have GPS data that might help. Might need to weight CTs zigzag. These data might help us test for assumptions of independence of the two spacial dimensions of offshore and along shore. SM has some offshore distribution graphs also (showed overheads). Different lines are different months pooled for all years. 25% of coast done in intensive transects. Most look like the SB cluster 3 or 4. Suggest they look at year-to-year. JB offered to convert file to PDF so we can post on the web.

JB drew a graph showing the two distribution curves (clusters 1 and 3) and variability illustrating that the two types of offshore distributions may have a distance offshore where there is less variability (where the two lines intersect, at ~900m) and a point where there is greater variability (where the two lines are most divergent, at ~500m). Just looking at the simulation models, you can calculate the area covered by a transect as a portion of the total and use a binomial distribution to calculate means and variances.

Zigzag would be robust to along shore and off shore variability. JB would want to keep the zigzag transects on a grid rather than randomly placed. CT noted CVs of densities from zigzag configurations was lowest when he compared with the same area covered by parallel transects on the outer coast and Strait of Juan de Fuca during the summer and winter. Considered each zigzag transect as one unit for CV, variability is over time. CV could be somewhat lower just because of longer lengths of transects with zigzag, but not sure that's the case. The means were lower also.

JB suggested one way to stratify is Proportional Sampling, PPS. Puts proportionally more transects in the areas of the offshore distribution where numbers of birds are greater and less transects where densities are lower, saving you from wasting time and resources.

CJ/SM list of options. What's the population parameter we want to track? Overall density or an index? An overall density may show changes in the population over time whereas the index may not capture the changes if they don't capture the tail of the distribution. For example, if there is a shift in the population distribution (rather than an actual sharp decline) the index may not catch it. We want to make sure we're getting areas where change would show, not just hot spots. If overall density is the goal, throw out #1. JL Marine mammal surveyors don't track index trends anymore since they're working on setting take levels and need abundance measures. Index may be more precise on a per unit cost, but you get more information from overall density. (Trying to get the overall density is still an index, but should more closer approximate the population.)

Need to develop criteria to narrow down options. Look at precision, then cost per unit effort. First need to identify the objectives. Our target populations is still 0-5km offshore. Maybe two strata 0-3km and 3-5km. SB concerned about spending too much time in the 3-5km section. Maybe could change the amount of effort in 3-5 km in a North South section depending on

distributions in those areas. PPS will give us some of those suggestions.

How will we decide on a configuration? JB will get a group of candidates. Then pass that out to the group for logistical constraints. Is there any other data to help us? JB asked about additional analyses of existing data. Maybe a per strata effort? Might be useful to get additional data on temporal variability.

The group narrowed it down to four options:
1) parallel at random distances offshore;
2) parallel proportional design (resulting in stratification with different amounts of transects in each strata);
3) sawtooth; or
4) perpendicular.

What about length? Is it a problem? Probably want to finish a transect by the end of the day. Say 50 to 80 km.

SB For simulations their offshore grid was much finer than the along shore grid since their intensives were 10km long. SB did an ANOVA of temporal, offshore and along shore data. Q: Is SB going to look at the perpendicular and zigzag? SB planned to do perpendicular but not zigzag. JB will look at both. PPS won't tell us what amount to be in longer sawtooth. Use proportion of abundance to tell you that.

Time lines
SB Simulations won't be done until end of June. JB will need until the end of June also. Sherri wants to begin write up sooner. NB will develop an outline using past meeting summaries. TM has a study outline.

Spatial/temporal
CT 1. Can fill in the offshore distribution. Help define seasonally and annually where the birds are. Give an empirical basis for stratification. Will do within a week
2. Also can produce WA polygon maps. Will do within a week.
3. ANOVA or components of variance on these data sets. Will do by end of field season.

CT asked for assistance interpreting the results of components of variance analysis. JB will develop a program to interface the different computer programs. JB will also send the program to SM to run her data. Should CT focus on areas where he has the most data? Yes. Best to have the most samples covering the same area within the breeding season and as many years as possible.

Survey Methods
Update on Boat avoidance. We are trying to: 1) see if there is movement and 2) see if there are missed birds. You assume random movement but the question is it directional (away from the boat). Had an Independent Observer (IO) looking ahead of the Standard Observers (SO) ostensibly to see birds before they moved in response to the boat. Two possible outcomes: SO

either missed the bird or saw it. When the SO saw the bird, the IO would take another measurement of the bird's distance from the transect line at the time the SO observed it to assess movement. IO also recorded behavior.

Q: How do you tease out the IO error? A: You measure the proportion of the IO to the SO. Problem is that IO will have the same viewing difficulties on the boat. This data suggests heterogeneity of detectability. Flying bird were not missed. Diving birds were missed. 10 m average movement. JL doesn't think movement of 10 m is a problem, but missing birds is. Zone of observation will be different. So will crews. Missing birds is a source of error. You can try and correct for it with an IO or ignore it. Use IO to adjust g(0). JL concerned more about bias than variability. Missing 10 % of birds on the line means a 10% underestimate of density.

SB suggests having two observers is better. Discussion about using IO to estimate bias. High density areas may be a problem for using IOs in the long term; however, for the Boat Avoidance study they only used the observations when there was no question which birds the SO saw. Could you look at the data to see if the days when it was high density was the times when SOs missed? TM reminder that inter-observer error must be smaller than sampling error.

The group consensus was to have an IO as a part of the monitoring program in the beginning couple of years. May also be part of the QA/QC program.

What about survey method tests this year? Everyone has a list of reports along with our original list of tasks. NB will ask everyone to prioritize which they feel are most important. Of those tasks, we want to coordinate the efforts and sampling designs, etc. of any attempts to test methods. This is so the team is reasonably comfortable with the way tests are conducted and their results by the time we reach the 2000 field season. We will do this via email and/or conference call. SM handed out a study proposal relating to survey methods for comments and suggestions.

The next meeting date was not set. We will discuss survey methods via email and conference calls.

NB gave the group a proposed schedule for population monitoring (see below). SM suggested we begin writing before October.

Marbled Murrelet Monitoring Program	Jun 1999	Jul	Aug	Sep	Oct	Nov	Dec	Jan 2000	Feb	Mar	Apr	May
Refine Sampling Design	x	x	x	x	x	x						
Refine Survey Methods	x	x	x	x	x	x						
Write Program					x	x						
Obtain Peer Review						x	x	x	x			
Incorporate Comments									x	x	x	
Implement Program												x

Refine Sampling Design - Continue defining target population. Determine transect configurations, replications, and locations along the Washington, Oregon, and California coast.

Refine Survey Methods - Coordinate pertinent tests of the survey methods. Bring the existing data sets together. Begin to develop a centralized data clearing house. Obtain consensus on a standardized survey method, training program, and quality assurance/quality control measures.

Write Program - Prepare a document explaining the sampling design, survey methods, training program, and QA/QC.

Obtain Peer Review - Send the proposed population monitoring program out to appropriate reviewers.

Incorporate Comments - Respond to relevant reviewer's comments via changes to the document.

Implement Program - Begin Marbled Murrelet Population Monitoring Program.